

*Application No. 09/955,722
SD-6436.1 S-97675*

REMARKS

Objection to the Drawings

The Office objected to the Drawings as not including the following reference signs not mentioned in the description: element 40, 42, 44, and 46 from Fig. 2B.

In response, Applicants amended the Specification to include the following sentence:

-- A schematic MEMS device 40 is shown, having MEMS elements 24 comprising two polysilicon gears 42, 44 and a linkage bar 46. --

Support for this addition can be found at col. 8, lines 4-7 of US patent 6,335,224 (Serial No. 09/572,562), which was incorporated by reference in the instant application.

Status of Claims

- Claims 1-44 are cancelled.
- Claims 45-60 are currently pending.

Claim Amendments

In this response, claims 45-60 were amended to further clarify and distinguish the present invention over the prior art of record. The words "temporary" and "immobilizing" were added to the word "coating", and the word "protective" was deleted, in order to indicate that the coating is only a temporary coating whose function is to immobilize any movable, released MEMS elements (e.g., gears, mirrors, beams), in particular, during the fabrication process. The word "non-functioning" was added to the preamble to indicate that the MEMS device is not functional when movable MEMS elements are immobilized by the temporary coating.

Application No. 09/955,722
SD-6436.1 S-97675

The phrase:

"wherein said temporarily protected, non-functioning MEMS device represents an intermediate step in the process of fabricating a fully-functional MEMS device"

was added to clearly indicate that the apparatus recited in claims **45-60** is not a fully-functioning final structure, but, rather, only an intermediate, non-functioning structure representative of an intermediate step or stage in the process of manufacturing the final, functional structure. Since the MEMS structures are immobilized by the temporary coating, the MEMS device is inherently non-functioning at this stage in the assembly/fabrication process.

Claim Rejections under 35 USC 103(a)

The Office rejected claims **45-48** and **52-57** under 35 USC 103(a) as being unpatentable over Kao, et al. (US 5,923,955) in view of Noordgraaf et al.. The Office also rejected claims **49-51** and **58-60** under 35 USC 103(a) as being unpatentable over Kao, et al. (US 5,923,955) in view of Noordgraaf et al., and further in view of Murakami et al. (US 4,691,225).

Applicants desire that all of the currently amended, pending claims **46-60** stand or fall as a single group, and the following arguments are directed to the entire set of claims.

Response to Examiner's comments in the Advisory Action of 09/02/04

The Office states in the Advisory Action of 09/02/04: "*The water-soluble first layer [Kao's] is used in the process of formation of the MEMS device and does not function in the same way as Noordgraaf's parylene coating. Noordgraaf's parylene coating is formed after the formation of the MEMS device and is part of the final structure, whereas Kao's water-soluble first layer is used in an intermediate step of forming the MEMS device and is consequently removed.*" Applicants agree completely.

Application No. 09/955,722
SD-6436.1 S-97675

In other words, *Noordgraaf's* coating protects and insulates the final structure of a functional electronic device by covering the device with a first layer of parylene to provide electrical insulation, followed by a second layer of a electrically conducting material to provide electromagnetic shielding.

In contrast, *Kao's* water-soluble first layer is a temporary, protective coating that is removed by dissolving in water after the wafer has been cut into individual dies.

Finally, the Office states in the Advisory Action of 09/02/04: "*Therefore, it would have been obvious to one of ordinary skill in the art to include Noordgraaf's parylene coating to the final structure of Kao's device in order to isolate and protect it.*"

Despite my interview with the Examiner, I am not completely clear what he means by the phrase "the final structure of Kao's device". I think he means the released MEMS device after the water-soluble first layer has been removed by washing the singulated dies in water (which also causes detachment of the water-insoluble second layer, in *Kao's* invention). So, I think the Examiner means that "*the final structure of Kao's device*" is a bare, released, functional MEMS device (i.e., with movable elements) on a singulated die (after wafer cutting) without any coatings at all.

In its obviousness rejection, the Office combines *Kao's* "final structure" with the *Noordgraaf* to produce a parylene-coated, released, fully-functioning MEMS device. There is nothing wrong with applying an extremely thin layer of parylene to the movable elements of a released, functioning MEMS device, i.e., so thin that the motion of the movable elements is not restricted or hindered. Such a combination, while interesting and useful, however, is not what is specifically described in claims 45-60.

Claims 45-60 require that the temporary, immobilizing coating be **sufficiently thick** so as to "**immobilize any movable elements of the released MEMS device.**" Such a thick coating inherently renders the device non-functional at that stage in the fabrication process. As described in the Specification, applicant's motivation for immobilizing these movable elements at this stage is to protect the fragile, released MEMS structures from mechanical, electrical, shock, vibration, or chemical damage/contamination during

Application No. 09/955,722
SD-6436.1 S-97675

subsequent fabrication and packaging steps (e.g., die singulation, handling, die attachment, wirebonding, packaging, sealing, etc.).

Noordgraaf teaches using parylene only to protect the final structure of a fully-functional electronic device; nowhere does he teach using parylene to immobilize and make non-functional a released MEMS device (*Noordgraaf* doesn't even mention MEMS devices). Clearly, there is no teaching, motivation, or suggestion in *Noordgraaf* to apply a thick coating of parylene to released MEMS elements in order to immobilize them and make them non-functional. So, one must look at the other reference, *Kao et al.*, to see if *Kao* provides any suggestion or motivation to use *Noordgraaf*'s parylene coating in *Kao*'s invention. First, let us review *Kao*'s invention.

Kao et al. teaches using a **temporary coating** for keeping sawing debris from contaminating MEMS devices during wafer singulation (sawing, water jet cutting, etc.). Then, *Kao* teaches that the temporary coating is **removed** after singulation to re-release the MEMS elements and make the device fully-functional. *Kao* discloses two different types of primary coatings (i.e., the first layer that directly contacts the released MEMS elements). First, he discloses using **photoresist**, but then he teaches away from this because it requires environmentally-unfriendly **acetone** to dissolve and remove the coating. Then, he teaches that his preferred material is a **water-soluble** first layer, because this advantageously allows the protective coating to be removed/detached using environmentally-friendly **water**. This is a critical feature of *Kao*'s invention (i.e., water-solubility), which enables this important functional aspect (i.e., use of environmentally-friendly solvents (e.g., water) to remove the temporary first layer).

In particular, *Kao* does not teach or suggest a temporary coating that is insoluble in water and organic solvents, which is selected from the group selected from the group consisting of parylene, carbon, amorphous carbon, diamond-like carbon, perfluoropolyether, and perfluorodecanoic carboxylic acid, as is recited in **Claim 45**.

Since *Noordgraaf*'s parylene coating is **not** water-soluble, if it were to be used as *Kao*'s temporary first layer, then it **would not function in the same way** as required by *Kao*'s teachings; i.e., it **would not** have the important property of being removable by water. Thus, the combination of *Noordgraaf* with *Kao et al.* would **render Kao's invention unsatisfactory for its intended purpose**, since parylene cannot be

*Application No. 09/955,722
SD-6436.1 S-97675*

removed with water. Clearly, *Kao* does not provide any suggestion or motivation to use *Noordegraaf's* parylene coating. Without such a suggestion or motivation, a *prima facie* case of obviousness cannot be supported.

Additionally, since *Kao* teaches away from using a water-soluble temporary first layer (e.g., photoresist), this "teaching away" provides significant evidence of non-obviousness of the present invention.

In summary, the Office has failed to provide adequate suggestion or motivation from the prior art to combine the references. Also, applicants submit that the proposed combination renders the prior art unsatisfactory for its intended purpose.

Since the Office has failed to adequately support its assertion that claims 45-60 are obvious in view of the cited prior art, then the rejections under 35 USC 103(a) should be withdrawn. Accordingly, claims 45-60 are in condition for allowance.

Application No. 09/955,722
SD-6436.1 S-97675

CONCLUSION

Applicants have responded to each and every objection and rejection, and urge that CURRENTLY AMENDED claims 45-60 as presented are now in condition for allowance. Applicants request expeditious processing to issuance.

The Office is hereby authorized to charge Deposit Account # 19-0131 for a one-month extension of time under 37 CFR 1.136(a).

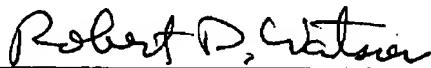
Respectfully submitted,



Robert D. Watson
Agent for Applicants
Reg. No. 45,604
Ph: (505) 845-3139
Fax: (505) 844-1418
e-mail: rdwatso@sandia.gov
Sandia National Laboratories
P.O. Box 5800 MS-0161
Albuquerque, NM 87185-0161

Certificate of Transmission under 37 CFR 1.10

I hereby certify that this correspondence was transmitted via facsimile to the U.S. Patent and Trademark Office at phone no. 703-872-9319 on 09/16/2004 (date).



Robert D. Watson